CEDAR KEYS
NATIONAL WILDLIFE REFUGE
WILDERNESS

A Report on Wilderness Character Monitoring

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INTRODUCTION

The purpose of this report is to establish a baseline assessment and monitoring strategy for the Cedar Keys National Wildlife Refuge Wilderness as a part of an interagency initiative to monitor trends in Wilderness character throughout the National Wilderness Preservation System. The Wilderness Act of 1964 was established to protect natural lands from the seemingly endless threat of "expanding settlement and growing mechanization." Section 4(b) of the Wilderness Act states that "each agency administering any area designated as wilderness shall be responsible for preserving the wilderness character of the area." The Wilderness Act defines Wilderness as having the following qualities:

Untrammeled
"An area where the earth and its community of life are untrammeled by man"

Undeveloped
"An area of undeveloped Federal land … without permanent improvements or human habitation"

Natural
"Protected and managed so as to preserve its natural conditions"

Solitude or Primitive and Unconfined Recreation
"Has outstanding opportunities for solitude or a primitive and unconfined type of recreation"

Other Features
"May also contain ecological, geological, or other features of scientific, educational, scenic, or historical value"

In 2008, the Interagency Wilderness Character Monitoring Team – representing the Department of the Interior Bureau of Land Management, U.S. Fish and Wildlife Service, National Park Service, U.S. Geological Survey and the U.S. Forest Service (Department of Agriculture) – published a strategy for monitoring wilderness character based on the aforementioned qualities. This strategy divides each quality into a hierarchical set of monitoring questions, indicators, and measures to assess trends in Wilderness Character. While the qualities, monitoring questions and indicators are nationally consistent, measures are specific and sometimes unique to individual Wilderness areas. This approach balances national and local needs for monitoring by defining locally relevant measures whose trends can be compiled at higher levels for national or regional reporting. This interagency monitoring strategy provides:

- Information for improving on-the-ground wilderness stewardship, policy review, and implementation based on credible data that are consistently collected and endure over time as personnel change;
- Accountability for the legal and policy mandates "to preserve wilderness character" that apply to all four wilderness management agencies;
- A set of key wilderness stewardship goals that are common across all the agencies with responsibility for wilderness and those that are tied to the legislative direction of the 1964 Wilderness Act; and
- A tool for communicating wilderness stewardship needs and priorities within the agencies and with the public.

For more information on the interagency wilderness character monitoring strategy applied in this report see *Keeping it Wild: An Interagency Strategy to monitor Trends in Wilderness Character Across the National Wilderness Preservation System* (2008).

HISTORY OF ESTABLISHING THE WILDERNESS

The Cedar Keys NWR was established on July 16, 1929, by Presidential Executive Order 5158, to protect a breeding ground for colonial nesting migratory birds. The Executive Order included North Key, Snake Key, and Deadman's Key. Seahorse Key was added to the refuge in a second Executive Order on November 6, 1939. On August 7, 1971 the Cedar Keys were designated as Wilderness under the Wilderness Act of 1964. Additional islands have since been purchased and added to the refuge. None of the additional islands have been designated as Wilderness.

This Refuge was initially established to protect colonial birds during a time when market hunters, desiring feathers for the ladies' apparel industry, were slaughtering millions of birds. Today, the threat is much different. Coastal habitat is being lost to rapid development. Historically, up to 200,000 birds nested on Snake and Seahorse Keys. Unfortunately, nesting bird populations have declined significantly. Recent data show that only 10,000 white ibis; yellow-crowned night, and tri-colored herons; cormorants; and brown pelicans nest on Seahorse Key annually. Snake Key has not been used for nesting since the late 1960s. In order to protect the sensitive wildlife and habitat of the Cedar Keys Wilderness, all public use is prohibited on the islands' interior. Additional restrictions are placed around Seahorse Key during breeding bird season (March 1 through June 30).

Purposes of the Refuge and Wilderness Areas

The Cedar Key NWR was established:

> "*…as a refuge and breeding ground for birds and wild animals, subject to valid existing rights…"*
> (Executive Order 5158, July 16, 1929)
>
> *"…suitable for – (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species…"*
> (16 U.S.C. 460k-1)

The purpose of congressionally designated wilderness as defined by the Wilderness Act of 1964:

> *"For this purpose there is hereby established a National Wilderness Preservation System to be composed of federally owned areas designated by the Congress as "wilderness areas," and these shall be administered for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness…"*
> 16 U.S.C. 1131-1136, Section 2(a)

GEOGRAPHIC & ECOLOGICAL SETTING OF THE WILDERNESS

Cedar Keys NWR is located along the western coast of Florida, approximately 90 air miles north-northwest of Tampa and 60 miles southwest of Gainesville. Located in Levy County along the southern edge of the Big Bend Region, the 13 islands that make up the refuge surround the coastal town of Cedar Key, Florida, where State Road 24 terminates at the Gulf of Mexico.

The Cedar Keys provide important coastal barrier island habitat with maritime forests, salt marsh and the northern-most limit of mangrove swamps. A prominent sandy ridge distinguishes Seahorse Key from the other islands. The ridge crests at 52 feet above sea level, making it the highest point on Florida's Gulfcoast. The other keys barely make it to 20 feet above sea level. Higher elevations are dominated by an upland forest of cabbage palm, red bay, live oak, and laurel oak covers the ridge, with an understory of saw palmetto, yaupon, wild olive, prickly pear, eastern red cedar, and Spanish bayonet. Salt marsh and estuarine waters dotted with mangrove make up the lower elevations.

About 50% of Florida's salt marsh and more than 3,000 square kilometers of seagrass beds occur in the Big Bend Region, providing habitat for migratory birds, anadromous and interjurisdictional fish, and threatened and endangered species. The blend of these estuary and riverine habitats created a large, complex system. The seagrasses surrounding the islands are important for local shell fisheries and provide valuable habitat for manatees and juvenile sea turtles. Seahorse Key is home to one of the largest colonial wading bird rookeries in north Florida.

The refuge islands with their undisturbed, natural plant communities are important stopover points for migrating neotropical songbirds. They are important loafing and feeding areas to thousands of shorebirds and provide habitat for threatened and endangered species, and species of concern in the State of Florida. The most abundant bird species are white ibis, great egret, double-crested cormorant, snowy egret, tricolored heron, brown pelican, and great blue heron. Other birds of interest include bald eagles, osprey and wintering white pelicans. Reptiles are common as well, including a dense population of cottonmouth snakes. However, mammals are scared due to the shortage of fresh water.

MEASURES USED

The following sections describe in detail the measures identified for monitoring Wilderness character in the Wilderness areas of Cedar Keys NWR. At least one measure was developed for each nationally consistent indicator within the *Keeping it Wild* framework. The following items are addressed for each measure:

- Source and protocol for quantifying the measure
- Frequency of data collections (every 1 or 5 years)
- The minimum change that is required to indicate a trend in that measure
- Adequacy of the data (see Data Adequacy below)
- Context and relevance of a measure to its indicator
- Baseline value

These measures and 2012 baseline values have been entered into the Wilderness Character Monitoring (WCM) Database. As new data is entered every one or five years, the database will determine trends in Wilderness Character based on the conditions of each measure. For more information on the WCM Database, see the WCM Database User Guide

Data Adequacy

Data adequacy is defined as the reliability of the data to assess trends in the measure. There are two aspects of data adequacy: data quantity and data quality. Data quantity refers to the level of confidence that all appropriate data records have been gathered. Data quality refers to the level of confidence about the source(s) of data and whether the data are of sufficient quality to reliably identify trends in the measure. Each measure is evaluated for both quality and quantity based on the flowing qualifications:

Data Quantity

COMPLETE
There is a high degree of confidence that all data records have been gathered. For example, to assess the occurrence of nonindigenous invasive plants, a complete inventory of the wilderness was conducted or all likely sites were visited. Similarly, to assess visitor use, all trailheads were inventoried.

PARTIAL
There is a moderate degree of confidence that all data records have been gathered. For example, to assess the occurrence of nonindigenous invasive plants, a partial inventory was conducted or a sampling of sites was conducted in which these plants are likely to occur were visited. Similarly, visitor use was assessed at selected trailheads.

INSUFFICIENT
There is a low degree of confidence that all records have been gathered. For example, no inventory for nonindigenous invasive plants has been conducted, and visitor use was not assessed anywhere.

Data Quality

HIGH
There is a high degree of confidence that the quality of the data can reliably assess trends in the measure. For example, data on the occurrence of nonindigenous invasive plants is from ground-based inventories conducted by qualified personnel; for visitor use, data would come from visitor permit data.

MODERATE
There is a moderate degree of confidence about the quality of the data. For example, data on invasive plants could come from national or regional databases; for visitor use, data could come from trailhead registers.

LOW
There is a low degree of confidence about the quality of the data. For example, data on invasive plants and visitor use could come from professional judgment.

Undeveloped Quality

The Wilderness Act states that Wilderness is “an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation,” “where man himself is a visitor who does not remain” and “with the imprint of man’s work substantially unnoticeable.” This quality is degraded by the presence of structures, installations, habitations, the use of motor vehicles, motorized equipment, or mechanical transport that increases people’s ability to occupy or modify the environment, or other evidence of modern human presence or occupation.

Monitoring Question	Indicator	Measure
What are the trends in non-recreational development inside the Wilderness?	**Non-recreational installations, structures and developments**	Non-recreational installations, structures and developments in Wilderness
	Inholdings	Acres of inholdings
What are the trends in mechanization inside the Wilderness?	**Use of motor vehicles, motorized equipment, and mechanical transport**	Minimum Requirement Analyses permitting the use of motor vehicles, motorized equipment, or mechanical transport in Wilderness

UNDEVELOPED QUALITY [Non-recreational installations, structures and developments]

Non-recreational installations, structures and developments in Wilderness

Source and Protocol – *Every 5 years*
Currently, the only developments in the Cedar Keys Wilderness are refuge boundary signs and signs indicating visitor restrictions. Therefore, the value for this measure can be determined by counting the number of sign posts installed within Wilderness boundaries. Although future developments are not anticipated, they would also be included under this measure.

2012 Data Value – *60 (approximate)*

Significant Change
Any change in this measure is significant

Data Adequacy
Complete/High

Context and Relevance
The only structures or installations found in the Cedar Keys Wilderness are refuge boundary or signs indicating visitor restrictions. Unauthorized installations have not been an issue in this Wilderness.

UNDEVELOPED QUALITY [Inholdings]

Acres of inholdings

Source and Protocol – *Every 5 years*
Determine the total number of acres managed by organizations other than the federal land manager on wilderness islands.

2012 Data Value – *3.2 acres*

Significant Change
Any change in this measure is significant

Data Adequacy
Complete/High

Context and Relevance
The refuge relegates use and some management of a block of land to the University of Florida (UF) under a Memorandum of Understanding for research, education and public outreach purposes, and for the maintenance of a historic lighthouse. This property has significant developments and is used regularly as a marine lab research center. Although, this property is not an inholding by definition (since it is not actually owned by UF), it has been included in this measure since it is a developed property, managed in part by an organization other than the refuge.

Minimum Requirement Analyses (MRA) permitting the use of motor vehicles, motorized equipment, or mechanical transport in Wilderness

Source and Protocol – *Every 5 years*
Count the number of MRAs that permit the use of motor vehicles, motorized equipment, or mechanical transport in Wilderness.

2012 Data Value – *1*
One MRA will be completed for the management of invasive species in 2012. No MRAs have been completed in the past 5 years

Significant Change
Any change in this measure is significant

Data Adequacy
Complete/High

Context and Relevance
There is no use of motor vehicles, motorized equipment or mechanical transport on these islands. Since public use of the Wilderness is restricted, any use of motor vehicles, motorized equipment or mechanical transport in Wilderness would come from the refuge. These uses would be reflected in MRA.

Solitude or Primitive and Unconfined Recreation

The Wilderness Act states that Wilderness has "outstanding opportunities for solitude or a primitive and unconfined type of recreation." This quality is about the opportunity for people to experience Wilderness; it is not directly about visitor experiences per se. This quality is degraded by settings that reduce these opportunities, such as visitor encounters, signs of modern civilization recreation facilities and management restrictions on visitor behavior.

Monitoring Question	Indicator	Measure
What are the trends in outstanding opportunities for solitude inside Wilderness?	**Remoteness from sights and sounds of people inside the Wilderness**	Marine Debris
	Remoteness from occupied and modified areas outside the Wilderness	Cedar Key Boaters
What are the trends in outstanding opportunities for primitive and unconfined recreation inside the Wilderness?	**Facilities that decrease self-reliant recreation**	Agency-provided recreation facilities
	Management restrictions on visitor behavior	Index of restrictions on visitor behavior

Marine debris

Source and Protocol - *Annually*
Count the number of items, regardless of size or material, of debris collected off of Wilderness islands during the annual Cedar Key Coastal Cleanup.
Source: Sue Colson, Cedar Keys Chamber of Commerce

A baseline for this measure will be established in 2013

Significant Change
A 25% change in the number of items collected each year is significant enough to be considered a trend.

Data Adequacy
Insufficient/High – Not all of the Cedar Keys Wilderness islands are included in the costal cleanup. The number of volunteers that attend the cleanup has a significant impact on the amount of debris collected. For example, more volunteers means the extent and intensity of coast cleanups will increase, thereby potentially increases the number of items collects. The number of volunteers has increased dramatically in recent years.

Context and Relevance
Marine debris that washes ashore Wilderness islands can affect a visitor's sense of remoteness. It can also harm the environment by altering habitat, through consumption by wildlife or other means.

Cedar Key boaters

Source and Protocol - *Annually*
Determine the number of boat launch passes sold in the town of Cedar Key. Include number of annual passes for both local and out of town users as well as the number of single use, daily launch fees. Round to the nearest hundred. Source: Cedar Keys City Hall

2012 Baseline Value – *6,800*
NOTE: City Hall records the number of passes sold by fiscal year. This value represents sales from Oct. 1, 2011-Sept. 30, 2012. The 2013 value for this measure will represent sales from Oct. 1, 2012 – Sept. 30, 2013.

Significant Change
Any change in this measure is significant

Data Adequacy
High/Moderate – trends in this measure should be interpreted with caution. Individual annual passes are only counted once in this measure regardless of how often a boater uses their annual pass.

Context and Relevance
As the number of boaters in the region increases, a Wilderness visitor's sense of remoteness decreases. The town of Cedar Key is the source of the majority of boaters that use the waters around the Cedar Keys Wilderness. This measure acts as a proxy for the number of boats that run adjacent to the wilderness.

Agency-provided recreation facilities

Source and Protocol – *Every 5 years*
Count the number of facilities that the Refuge supplies to visitors that decrease self-reliant recreation

2012 Data Value – *0*
This measure is not expected to change

Significant Change
Any change in this measure is significant

Data Adequacy
Complete/High

Context and Relevance
There are no facilities that decrease self-reliant recreation in the Cedar Keys Wilderness and the Refuge has no intention of installing facilities of any kind. User-created facilities do not exist and there is no significant concern regarding the development of user-created facilities.

Index of restrictions on visitor behavior

Source and Protocol – *Every 5 years*

This measure was selected from the *Forest Service Technical Guide for Monitoring Selected Conditions Related to Wilderness Character.* Determine the proper weight for each restriction in the table provided below. Multiply that weight by its relative geographic extent:

1 – the restriction applies to a subarea of Wilderness
2 – the restriction applies to the entire Wilderness

The sum of the results is the value for this measure.

Context and Relevance

Wilderness should provide the public with opportunities for primitive and unconfined recreation. Visitors' opportunities to experience freedom from management are significantly affected by the number and type of regulations in place.

Significant Change

Any change in this measure is significant

Data Adequacy

Complete/High

Category	Score	Type of restriction
Campfires	0	No regulation
	1	Designated site, above designated elevation, or mandatory setback
	2	Total prohibition
Camping	0	No restriction
	1	Any mandatory setback; designated sites
	2	Assigned sites
Fees	0	No fees
	1	Fees charged of selected user type
	2	Fees charged of all visitors
Permits	0	No permit or registration
	1	Voluntary self-registration
	2	Mandatory, nonlimiting permit or registration
	3	Mandatory; use limited
Human waste	0	No regulation
	3	Pack out required
Length of stay	0	No restriction on length of stay
	1	Length of stay limited
Stock use	0	No restriction
	1	Mandatory setbacks; no hitching, tethering
	2	Grazing prohibited or feed restricted
	3	No camping with stock; area closures to all stock
Swimming/bathing	0	No restrictions
	2	Prohibited
Area closure	0	No restriction
	3	Area closed to use
Group size limits	0	No restriction
	1	Group size limits in place
Dogs/domesticated animals	0	No restrictions
	1	Required to be on leash
	2	Prohibited

This table includes the most common and significant restrictions placed on visitors to public lands as defined by the *Forest Service Technical Guide for Monitoring Selected Conditions Related to Wilderness Character.*

2012 Data Value

Category	Score	Geographic Weight	Total Score
Campfires	2	2	4
Camping	3 (total prohibition)	2	6
Fees	0	n/a	0
Permits	0	n/a	0
Human Waste	0	n/a	0
Length of Stay	0	n/a	0
Stock Use	0	n/a	0
Swimming/Bathing	0	n/a	0
Area Closure	3	1	3
Group Size Limits	0	n/a	0
Dogs/Domesticated Animals	1	2	2
Measure Value			**15**

Untrammeled Quality

The Wilderness Act states that Wilderness is “an area where the earth and its community of life are untrammeled by man,” and “generally appears to have been affected primarily by the forces of nature.” In short, Wilderness is essentially unhindered and free from modern human control or manipulation. This quality is degraded by modern human activities or actions that intentionally control or manipulate the components or processes of ecological systems inside the Wilderness.

Monitoring Question	Indicator	Measure
What are the trends in actions that control or manipulate the "earth and its community of life" inside Wilderness areas?	**Actions authorized by the federal land manager that manipulate the biophysical environment**	Invasive plant species management
		Invasive and/or nuisance animal species management
		Permitted special uses that manipulate the biophysical environment
	Actions NOT authorized by the federal land manager to manipulate the biophysical environment	Unauthorized access or activity in the Wilderness

Invasive plant species management

Source and Protocol – *Annually*
Number of hours spent managing invasive species. This measure includes both the "search" and "destroy" components of active invasive species management.

2012 Data Value – *TBD*

Significant Change
Any change in this measure is significant

Data Adequacy
Complete/High

Context and Relevance
Invasive species management is an intentional manipulation of the current ecological community regardless of the impact that those species may have on the natural ecology of the environment.

UNTRAMMELED QUALITY [Actions authorized by the federal land manager that manipulate the biophysical environment]

Invasive and/or nuisance animal species management

Source and Protocol – *Annually*
If management of invasive and/or nuisance animal species occurred on any island in a single year, record a value of 1. If no management for invasive and/or nuisance animal species occurred, record a value of 0.

2012 Data Value – *0*

Significant Change
Any change in this measure is significant

Data Adequacy
Complete/High

Context and Relevance
Raccoons and other mammals can swim to Wilderness islands at low tide. At high populations these nuisance species threaten native bird populations. If an issue arises the refuge may decide action is needed to manage the population on certain islands.

Permitted special uses that manipulate the biophysical environment

Source and Protocol – *Annually*
Count the number of special use permits that give authorization to individuals or organizations to manipulate or control any components or processes of the environment inside the Wilderness.

2012 Data Value – *2*
Two permits were issued this year to monitor snake populations. These permits authorized the use of pit tags and other manipulations of individual snakes for research purposes. 1 permit was issued to survey and collect samples of plant species on Seahorse Key and North Key. This permit does not indicate significant manipulation of the Wilderness and was therefore not included in the measure.

Significant Change
Any change in this measure is significant

Data Adequacy
Complete/High

Context and Relevance
All authorized, non-agency actions that significantly trammel the Wilderness are reflected in special use permits. No more than three permits a year have been issued for the manipulation of the environment inside the Wilderness in the past 5 years. This average is not expected to change.

Unauthorized access or activity in the Wilderness

Source and Protocol – *Annually*
Record the number of instances of unauthorized access or activity in the Wilderness (camping, campfires, trespassing, etc.). Legal enforcement is not required for an act to be included in this measure. For example, if a warning is given to an individual for trespassing, the instance should still be included in this measure. Source: Law Enforcement datasets.

2011 Data Value – *27*

Significant Change
Any change in this measure is significant. Trends in this measure should be interpreted with caution. The amount of time spent patrolling Wilderness will affect the number of instances reported.

Data Adequacy
Partial/Complete – Wilderness islands are not regularly surveyed by refuge staff. It is likely that not all instances of unauthorized access will be known to refuge staff.

Context and Relevance
The primary concern for this measure is trespassing in areas closed to the public. The interior of the Wilderness islands in Cedar Keys NWR are closed to public year round to protect sensitive wildlife habitat. There is an additional seasonal closure around Seahorse Key to protect nesting birds. Trespassing into these closed areas can disturb the environment and it's community of life.

Natural Quality

The Wilderness Act states that Wilderness is "protected and managed so as to preserve its natural conditions." In short, Wilderness ecological systems are substantially free from the effects of modern civilization. This quality is degraded by intended or unintended effects of modern people on the ecological systems inside the Wilderness since the area was designated.

Monitoring Question	Indicator	Measure
What are the trends in terrestrial, aquatic and atmospheric natural resources inside Wilderness?	**Plant and animal species and communities**	Invasive plant species
		Invasive and/or nuisance animal species
		Population dynamics of selected native species
	Physical Resources	Ozone pollution
		Total nitrogen wet deposition
		Total sulfur wet deposition
		Visibility
What are the trends in terrestrial, aquatic and atmospheric processes inside Wilderness?	**Biophysical Processes**	Accretion/erosion of Wilderness islands
		Departure from the natural fire regime

Invasive plant species

Source and Protocol – *Every 5 years*
Count the number of points where individual or clusters of invasive plant species are known to exist. An assessment of the location of invasive plant species should be completed at least once every 5 years. Invasive species information is currently managed by the Prescribed Fire Specialist.

2012 Data Value – *31 points*

North Key	1
Deadman's Key	0
Seahorse Key	29
Snake Key	1

Significant Change
Professional judgment should be used to determine if changes in this measure indicate a trend in the natural quality of Wilderness character.

Data Adequacy
Partial/Moderate – Individual points may indicate single plants or clusters of plants making this measure rather arbitrary. However, at the landscape level this measure is useful to determine if invasive species are spreading to areas where they did not previously exist.

Context and Relevance
Invasive species threaten the natural composition of the ecological community in Wilderness.

Invasive and/or nuisance animal species

Source and Protocol – *Annually*
Count the number of invasive and/or nuisance animal species on each island. This measure is the cumulative total across all islands for all animal species Invasive species information is currently managed by the Prescribed Fire Specialist

2012 Data Value – *2*

North Key	(1) Raccoons
Deadman's Key	(0) none
Seahorse Key	(1) Rats (managed by UF)
Snake Key	(0) none

Significant Change
Any change in this measure is significant

Data Adequacy
Complete/High

Context and Relevance
Invasive species threaten the natural composition of the ecological community in Wilderness

Population dynamics of selected native species

Source and Protocol – *Annually*

Four flight line surveys are completed each year during the breeding season. This measure is defined as the average number of birds of each species identified 'in' Seahorse Key during those surveys (rounded to the nearest whole number). This measure will be represented as a 11 separate measure in the WCM Database; one for each species of colonial wading birds that is monitored annually including: White Ibis (WHIB), Great egret (GREG), Snowy Egret (SNEG), Great Blue Heron (GRBH), Little Blue Heron (LIBH), Cattle Egret (CAEG), Cormorant (DCCO), Brown Pelican (BRPE), Tri-Color Heron (TRHE), Yellow Crown Night Heron (YCNH), Black Crown Night Heron (BCNH).

2012 Data Values

WHIB	53	DCCO	116
GREG	23	BRPE	72
SNEG	9	TRHE	6
GRBH	13	YCNH	0
LIBH	9	BCNH	3
CAEG	2		

Significant Change

This measure encompasses a great amount of natural variation. There must be at least a 40% increase or decrease before a trend can be considered in the natural quality of Wilderness character.

Data Adequacy

Partial/High – Only 4 surveys are taken at only one island in the Cedar Keys Wilderness each year. Although this island is known to have the greatest bird populations it may not be characteristic of the entire Wilderness.

Context and Relevance

This measure will indicate trends in the populations of the native colonial wading bird species for which the refuge was initially established to protect

Ozone Air Pollution

Source and Protocol – 5 years

Fourth highest 8-hr average ozone concentration in parts per billion (ppb) averaged over 5 years. Data for this measure is provided by the FWS Division of Inventory and Monitoring

2005-2009 Data Value – *70.2 ppb*

This average covers the most recent 5 years for which the Division of Inventory and Monitoring have complete datasets.

Significant Change

Changes in this measure are significant when the data value indicates a change in qualification from the previous five years based on the following conditions (i.e. the data value must move up to the good category or down to significant concern):

< 60	Good
61-75	Moderate
> 76	Significant Concern

Data Adequacy

Partial/Moderate – Data for this measure is not collected from the location of the Cedar Keys Wilderness. It is interpolated by the Division of Inventory and Monitoring from nearby air quality monitors.

Context and Relevance

The effects of air pollution can be detrimental to the refuge environment. Air pollutants can cause injury to vegetation, impair visibility, and change terrestrial and aquatic ecosystems. Measures of ozone pollution, nitrogen and sulfur concentrations and visibility are standard measures of air quality.

Total nitrogen wet deposition

Source and Protocol – 5 years
Concentration of nitrogen in atmospheric wet deposition in kg/ha. Data for this measure is provided by the FWS Division of Inventory and Monitoring

2005-2009 Data Value – *4.1 kg/ha*
This average covers the most recent 5 years for which the Division of Inventory and Monitoring have complete datasets.

Significant Change
Changes in this measure are significant when the data value indicates a change in qualification from the previous five years based on the following conditions (i.e. the data value must move down from Significant Concern):

<1	Good
1-3	Moderate
> 3	Significant Concern

Data Adequacy
Partial/Moderate – Data for this measure is not collected from the location of the Cedar Keys Wilderness. It is interpolated by the Division of Inventory and Monitoring from nearby air quality monitors.

Context and Relevance
The effects of air pollution can be detrimental to the refuge environment. Air pollutants can cause injury to vegetation, impair visibility, and change terrestrial and aquatic ecosystems. Measures of ozone pollution, nitrogen and sulfur concentrations and visibility are standard measures of air quality.

Total sulfur wet deposition

Source and Protocol – 5 years
Concentration of sulfur in atmospheric wet deposition in kg/ha. Data for this measure is provided by the FWS Division of Inventory and Monitoring

2005-2009 Data Value – *3.5 kg/ha*
This average covers the most recent 5 years for which the Division of Inventory and Monitoring have complete datasets.

Significant Change
Changes in this measure are significant when the data value indicates a change in qualification from the previous five years based on the following conditions (i.e. the data value must move down from Significant Concern):

<1	Good
1-3	Moderate
> 3	Significant Concern

Data Adequacy
Partial/Moderate – Data for this measure is not collected from the location of the Cedar Keys Wilderness. It is interpolated by the Division of Inventory and Monitoring from nearby air quality monitors.

Context and Relevance
The effects of air pollution can be detrimental to the refuge environment. Air pollutants can cause injury to vegetation, impair visibility, and change terrestrial and aquatic ecosystems. Measures of ozone pollution, nitrogen and sulfur concentrations and visibility are standard measures of air quality.

Visibility

Source and Protocol – 5 years
Scenic conditions that determine how well and how far a visitor of the Wilderness can see based on the amount of small particles in the air (measured in deciviews, dv) Data for this measure is provided by the FWS Division of Inventory and Monitoring

2005-2009 Data Value – *11.5 dv*
This average covers the most recent 5 years for which the Division of Inventory and Monitoring have complete datasets.

Significant Change
Changes in this measure are significant when the data value indicates a change in qualification from the previous five years based on the following conditions (i.e. the data value must move down from Significant Concern):

< 2	Good
2-8	Moderate
> 8	Significant Concern

Data Adequacy
Partial/Moderate – Data for this measure is not collected from the location of the Cedar Keys Wilderness. It is interpolated by the Division of Inventory and Monitoring from nearby air quality monitors.

Context and Relevance
The effects of air pollution can be detrimental to the refuge environment. Air pollutants can cause injury to vegetation, impair visibility, and change terrestrial and aquatic ecosystems. Measures of ozone pollution, nitrogen and sulfur concentrations and visibility are standard measures of air quality.

Accretion/Erosion of Wilderness islands

Source and Protocol – *5 years*
Determine the total area (in acres) of upland habitat from aerial photos of the Cedar Keys NWR. Source: Refuge Forester

2006 Data Value - *TBD*

Significant Change
A 5% change is considered a significant change in this measure.

Data Adequacy
Complete/High

Context and Relevance
Changing island shorelines due to erosion and accretion is natural processes. However, significant loss of island area due to these changes can indicate degradation in colonial wading bird habitat.

Departure from the natural fire regime

Source and Protocol – *Annually*
Count the number of user-generated fires set in Wilderness each year that significantly manipulate the biophysical environment inside the Wilderness (i.e. escaped campfires).

2012 Data Value – *0*

Significant Change
Any change is significant

Data Adequacy
High/Complete

Context and Relevance
Campfires are prohibited in the Wilderness due to the threat of igniting unnatural wildfires. The occasional unauthorized campfire that escapes its boundaries disrupts the natural fire regime within the Wilderness.

Other Features

The Wilderness Act states that Wilderness "may also contain ecological, geological, or other features of scientific, educational, scenic, or historic value."

Monitoring Question	Indicator	Measure
What are the trends in changes in cultural resources inside the Wilderness?	**Loss of cultural resources**	Disturbance of cultural resources

Disturbance of cultural resources

Source and Protocol – *Annually*
Count the number of times cultural resources, middens in particular, have been vandalized. Any evidence of distinct instances of disturbance to cultural resources should be included in this measure. Legal action is not required for the instance to be included. Source: Law Enforcement datasets.

2012 Data Value – *1*

Significant Change
Any change in this measure is significant. Trends in this measure should be interpreted with caution. The amount of time spent patrolling Wilderness will affect the number of instances reported.

Data Adequacy
Partial/Complete – it is unlikely that refuge staff will have accurate knowledge of all disturbances to cultural resources in the Wilderness

Context and Relevance
The Cedar Keys Wilderness shows clear evidence of historic human activity. Middens, found throughout the refuge are often scavenged for valuable items. A civil war cemetery also exists on Seahorse Key. These cultural resources add to the value of Wilderness.

Measures Not Used

Number of indigenous species that are listed as threatened and endangered, sensitive, of concern, or extinct since the time of Wilderness designation

This measure was discarded from the Wilderness Character Assessment because the number of T/E species in in this Wilderness does NOT reflect the condition of the plant and animal species and communities. The ecological community in the Cedar Keys Wilderness could be in pristine condition regardless of the number of endangered species is harbors. Furthermore, changes in the wilderness character of these islands are not expected to significantly impact endangered species populations.

Number of research installations

Research installations are few and far between in this refuge. They are not considered a monitoring priority. What installations do occur are reflected in special use permits which are counted under the untrammeled quality. In the past five years, the only research installations that have occurred in the Wilderness include pit tags on marine snakes for population monitoring and a bird banding project in 2008 and 2009, authorized by special use permits.

Index of motorized equipment use and mechanical transport

There is no use of motorized equipment and mechanical transport in this refuge. This measure was determined to be excessive for the purposes of quantifying the motorized equipment use and mechanical transport indicator. The number of MRAs that indicated the use of motorized equipment use and mechanical transport acts as a proxy for this index.

PROCESS USED FOR IDENTIFYING MEASURES

1. *Explore the Wilderness.* I toured the Cedar Keys Wilderness with Law Enforcement staff in my first week at the refuge. Conversations about the Wilderness, in the Wilderness, helped frame my thoughts about developing a set of measures specific to this refuge.

2. *Read the CCP*. As I read through the CCP, I reflected on the conversations I had with Law Enforcement and other staff about the reality of managing this Wilderness. I made a list of questions, ideas, and potential impacts that I felt were significant to Wilderness Character and feasible to measure.

3. *Share thoughts with refuge staff.* I shared my thoughts at a weekly staff meeting and recorded their input about measures.

4. *Refine measures.* During the meeting with refuge staff, I identified individual staff members with the proper expertise to discuss and refine individual measures.

5. *Repeat steps 3 and 4.* In order to ensure that all critical impacts were accounted for and that each measure was feasible and reliable, I continued to present refined measures at weekly staff meetings and addressed all comments until the staff accepted a comprehensive set of measures.

6. *Gather data.* After completing a list of measures, I gathered data on each measure. In some cases, the baseline data was available immediately upon identification of the measure and was recorded at that time. Otherwise, I waited to gather the data until after the measure was accepted by refuge staff.

7. *Input measures and baseline data into database.*

8. *Distribute draft report.* I finalized a draft of my wilderness character monitoring report and distributed it amongst the refuge staff for review.

9. *Incorporate edits.*

DOCUMENTS CONSULTED

- Lower Suwannee & Cedar Keys National Wildlife Refuges: Comprehensive Conservation Plans
- Keeping it Wild: An Interagency Strategy to Monitor Trends in Wilderness Character Across the National Wilderness Preservation System
- Wilderness.net
- FY12 Cedar Keys NWR Invasive Plant project: Brazilian Pepper Eradication on Coastal Islands
- Special Use Permits

STAFF CONSULTED

Name	Position Title
Larry Woodward	Deputy Refuge Manager
Ken McCain	Law Enforcement Officer
Daniel Barrand	Forester
Vic Doig	Prescribed Fire Specialist
Andrew Gude	Refuge Manager

CONCLUSIONS

An assessment of the current condition of the Cedar Keys Wilderness indicates that the Wilderness character of this Wilderness area is well preserved. The Cedar Keys Wilderness is undeveloped, natural, and untrammeled. Middens and archaeological sites even offer insight into human history. However, from a public use perspective, this Wilderness is lacking. Located less than 5 miles from the town of Cedar Keys, Wilderness visitors are hard-pressed to find seclusion from the developed world. Furthermore, most of the Cedar Keys Wilderness is closed to public use in order to protect sensitive wildlife and habitat – a consequence of the establishing purposes of the refuge. Only a few locals take advantage of the beaches that are open to Wilderness visitors. Balancing public use with preserving the natural functions of the environment is difficult in this Wilderness. The refuge might consider increasing public use in a way that promotes Wilderness stewardship such as community trips to the island for education on "leave no trace" principles or other Wilderness related activities. These events would also comply with the refuge public use objectives outlined in the CCP.

The most significant degradation of Wilderness character in the Cedar Keys is the continuous decline in nesting bird populations over the past 20 years. More extensive research is required to determine the cause of this decline. Unfortunately, the refuge is limited by staff and funding. For now, continuing to monitoring populations will at least provide a foundation for future work. Some work could also be contracted out to other organizations if necessary.

The Wilderness character monitoring protocol established in this report will be a useful tool for acknowledging other trends in Wilderness Character of the Cedar Keys NWR. The plan consists of 21 measures in total (3 Undeveloped, 4 Solitude or Primitive and Unconfined Recreation, 4 Untrammeled, 9 Natural, and 1 Other Features), developed from data that is already collected by refuge staff. Although this list is not exhaustive, the measures selected represent the most significant and measurable features of Wilderness in Cedar Keys NWR and adequately represent the qualities of Wilderness character. As additional or more precise information becomes regularly available to refuge staff, it can easily be incorporated into the Wilderness Character monitoring protocol. This plan will promote Wilderness stewardship and support future management decisions in the Cedar Keys Wilderness.

APPENDIX A: Priority Ranking Of All Measures Considered

The following criteria are used to assign priority to each measure:

A. Level of significance (the measure is highly relevant to the quality and indicator of wilderness character, and is highly useful for managing the wilderness):

High = 3 points
Medium = 2 points
Low = 1 point

B. Level of vulnerability (measures an attribute of wilderness character that currently is at risk, or might likely be at risk over 10-15 years):

High = 3 points
Medium = 2 points
Low = 1 point

C. Degree of reliability (the measure can be monitored accurately with a high degree of confidence, and would yield the same result if measured by different people at different times):

High = 3 points
Medium = 2 points
Low = 1 point

D. Degree of feasibility (the measure is related to an existing effort or could be monitored without significant additional effort):

High = 1 point
Low = 0 point
(if 0 is given, do not use)

POTENTIAL MEASURE	Criteria for Prioritizing Potential Measures				OVERALL SCORE
	A. Significance	B. Vulnerability	C. Reliability	D. Feasibility	
UNTRAMMELED QUALITY					
Indicator: Authorized actions that manipulate the biophysical environment **Measure:** Invasive plant species management	3	1	3	1	8
Indicator: Authorized actions that manipulate the biophysical environment **Measure:** Invasive and/or nuisance animal species management	3	1	2	1	7
Indicator: Authorized actions that manipulate the biophysical environment **Measure**: Permitted special uses that manipulate the biophysical environment	3	1	3	1	8
Indicator: Unauthorized actions that manipulate the biophysical environment **Measure:** Unauthorized access or activity in the Wilderness	2	2	2	1	7
NATURAL QUALITY					
Indicator: Plant and animal species and communities **Measure:** Invasive plant species	3	2	2	1	8
Indicator: Plant and animal species and communities **Measure:** Invasive and/or nuisance animal species	3	2	3	1	9
Indicator: Plant and animal species and communities **Measure:** Population dynamics of selected native species	3	3	2	1	9
Indicator: Plant and animal species and communities **Measure: I**ndigenous species listed as threatened and endangered, sensitive, of concern, or extinct since the time of Wilderness designation	1	1			2
Indicator: Physical resources **Measure:** Ozone pollution	3	2	3	1	9
Indicator: Physical resources **Measure:** Total nitrogen wet deposition	3	3	3	1	10

Indicator: Physical resources **Measure:** Total sulfur wet deposition	3	3	3	1	10
Indicator: Physical resources **Measure:** Visibility	3	3	3	1	10
Indicator: Biophysical processes **Measure:** Accretion/Erosion of Wilderness islands	3	1	3	1	8
Indicator: Biophysical processes **Measure:** Departure from the natural fire regime	3	1	3	1	8
UNDEVELOPED QUALITY					
Indicator: Non-recreational structures, installations, or developments **Measure:** Non-recreational structures, installations, or developments	2	1	3	1	7
Indicator: Non-recreational structures, installations, or developments **Measure:** Number of research installations	1	1			2
Indicator: Inholdings **Measure:** Acres of inholdings	2	1	3	1	7
Indicator: Use of motor vehicles, motorized equipment, or mechanical transport **Measure:** MRAs permitting the use of motor vehicles, motorized equipment, or mechanical transport in Wilderness	3	1	3	1	8
SOLITUDE OR PRIMITIVE AND UNCONFINED RECREATION QUALITY					
Indicator: Remoteness from sights and sounds of people inside the wilderness **Measure:** Marine debris	2	2	1	1	6
Indicator: Remoteness from occupied and modified areas outside the wilderness **Measure:** Cedar Keys boaters	2	1	2	1	6
Indicator: Facilities that decrease self-reliant recreation **Measure:** Agency-provided recreation facilities	3	1	3	1	8
Indicator: Management restrictions on visitor behavior **Measure:** Management restrictions on visitor behavior	3	1	3	1	8
Other Features Quality (if applicable)					
Indicator: Loss of cultural resources **Measure:** Disturbance to cultural resources	3	2	2	1	8

APPENDIX B: Summary of Effort Required for Wilderness Character Monitoring

Quality	Indicator	Measure	Were data gathered from office paper files, computer files, or field work (professional judgment is an option)?	Time you spent gathering data for each measure (in whole hours)	Comments
Untrammeled	Authorized actions	Invasive plant species management	Field work/paper files	1	Many days will be spent managing species but it only takes a few minutes to add and record those hours in the database.
	Authorized actions	Invasive and/or nuisance animal species management	Common knowledge among staff	0	
	Authorized actions	Permitted special uses that manipulate the biophysical environment	Paper Files	1	
	Unauthorized actions	Unauthorized access or activity in the Wilderness	Computer Files	0	Law Enforcement datasets
Natural	Plant and animal species	Invasive plant species	Field Work	30	
	Plant and animal species	Invasive and/or nuisance animal species	Observation in the field	0	
	Plant and animal species	Population dynamics of selected native species	Paper Files	1	The paper files consulted for this measure are the results of annual field research
	Physical resources	Air Quality (ozone pollution, total nitrogen and sulfur wet deposition, visibility)	Computer Files	1	Provided by the Department of Inventory and Monitoring
	Biophysical processes	Accretion/Erosion of Wilderness islands	Computer Files	2	GIS software and aerial photographs are used to quantify this measure

Natural	Biophysical processes	Departure from the natural fire regime	Common knowledge among staff	0	Wildfire is rare. Staff generally know whether or not an unnatural fire occurred in the Wilderness.
Undeveloped	Non-recreational structures, installations, and developments	Non-recreational installations, structures and developments in Wilderness	Common knowledge among staff	1	
	Inholdings	Acres of inholdings	Paper Files	0	Property Lease description
	Use of motorized or mechanical	Minimum Requirement Analyses (MRA) permitting the use of motor vehicles, motorized equipment, or mechanical transport in Wilderness	Paper Files	1	
Solitude +	Remoteness from inside	Marine Debris	Paper Files	1	Sue Colson - Cedar Keys Chamber of Commerce
	Remoteness from outside	Cedar Key boaters	Computer Files	1	City Hall
	Facilities that decrease self-reliant recreation	Agency-provided recreation facilities	N/A	0	No facilities exist
	Mgmt restrictions on visitor behavior	Management restrictions on visitor behavior	Common knowledge among staff	0	
Other Features	Loss of cultural resources	Disturbance of cultural resources	Computer Files	0	Law Enforcement datasets

Effort by Wilderness Fellow:

Time you spent to identify, prioritize, and select all the measures (in whole hours)	Time you spent to learn how to enter data into the WCM database application (in whole hours)	Time you spent to enter all data into the WCM database application (in whole hours)	Time you spent on other tasks directly related to WCM (e.g., reading CCP, giving presentations, talking with staff) (in whole hours)	Time you spent doing <u>other</u> Refuge tasks not directly related to WCM (in whole hours)
110	5	20	65	40

Effort by Refuge Staff:

Title of staff involved in identifying, prioritizing, and selecting measures	Staff time to identify, prioritize, and select measures (in whole hrs)
Prescribed Fire Specialist	10
Law Enforcement Officer	10
Refuge Manager	5
Forester	10
Deputy Refuge Manager	5

APPENDIX C: Data Sources and Protocols for All Measures Used

Measures that earned a priority ranking score between 8 and 10 received High Priority
Measures that earned a priority ranking score between 5 and 7 received Medium priority

Measure	**Priority (H, M, L)**	**Detailed Description of the Data Source(s) and Protocols for How the Data Were Gathered**
Untrammeled Quality		
Invasive plant species management	H	Count the number of hours spent to "search and destroy" invasive plant species in the Wilderness.
Invasive and/or nuisance animal species management	M	If management of invasive and/or nuisance animal species occurred on any island in a single year, record a value of 1. If no management for Invasive and/or nuisance animal species occurred, record a value of 0.
Permitted special uses that manipulate the biophysical environment	H	Count the number of special use permits that give authorization to individuals or organizations to manipulate or control any components or processes of the environment inside the Wilderness.
Unauthorized access or activity in the Wilderness	M	Record the number of instances of unauthorized access or activity in the Wilderness (camping, campfires, trespassing, etc.). Legal enforcement is not required for an act to be included in this measure. Source: Law Enforcement datasets
Natural Quality		
Invasive plant species	H	Count the number of points where individual or clusters of invasive plant species are known to exist. Invasive species information is currently managed by the Prescribed Fire Specialist
Invasive and/or nuisance animal species	H	Count the number of invasive and/or nuisance animal species on each island. This measure is the cumulative total across all islands for all animal species invasive species information is currently managed by the Prescribed Fire Specialist
Population dynamics of selected native species	H	Four flight line surveys are completed each year during the breeding season. This measure is defined as the average number of birds of each native colonial wading species identified 'in' Seahorse Key during those surveys (rounded to the nearest whole number). Species include: White Ibis (WHIB), Great egret (GREG), Snowy Egret (SNEG), Great Blue Heron (GRBH), Little Blue Heron (LIBH), Cattle Egret (CAEG), Cormorant (DCCO), Brown Pelican (BRPE), Tri-Color Heron (TRHE), Yellow Crown Night Heron (YCNH), Black Crown Night Heron (BCNH). The Prescribed Fire Specialist manages data on these counts.

Air Quality (including ozone pollution, total nitrogen and sulfur wet deposition, and visibility)	H	Data provided by inventory and monitoring.
Accretion/Erosion of Wilderness islands	H	Determine the total area of upland habitat from aerial photos of the Cedar Keys NWR. Source: Refuge Forester
Departure from the natural fire regime	H	Count the number of user-generated fires set in Wilderness each year that significantly manipulate the biophysical environment inside the Wilderness (i.e. escaped campfires).
Undeveloped Quality		
Non-recreational installations, structures, and developments in Wilderness	M	Currently, the only developments in the Cedar Keys Wilderness are refuge boundary signs and signs indicating visitor restrictions. Therefore, the value for this measure can be determined by counting the number of sign posts installed within Wilderness boundaries.
Acres of inholdings	M	Determine the total number of acres managed by organizations other than the federal land manager on wilderness islands. This measure is not expected to change.
Minimum Requirement Analyses permitting the use of motor vehicles, motorized equipment, or mechanical transport in Wilderness	H	Count the number of MRAs that permit the use of motor vehicles, motorized equipment, or mechanical transport in Wilderness.
Solitude or Primitive and Unconfined Quality		
Marine debris	H	Count the number of items, regardless of size or material, of debris collected off of Wilderness islands during the annual Cedar Key Coastal Cleanup. Source: Sue Colson, Cedar Keys Chamber of Commerce
Cedar Key boaters	M	Determine the number of boat launch passes sold in the town of Cedar Key. Include number of annual passes for both local and out of town users as well as the number of single use, daily launch fees. Round to the nearest hundred. Source: Cedar Keys City Hall
Agency provided recreation facilities	H	Count the number of facilities that the Refuge supplies to visitors that decrease self-reliant recreation
Management restrictions on visitor behavior	H	Use the Forest Service Index of management restrictions to assign relative weight and geographic extent of management restrictions.
Other Features		
Disturbance of cultural resources	H	Count the number of times cultural resources, middens in particular, have been vandalized. Any evidence of distinct instances of disturbance to cultural resources should be included in this measure. Legal action is not required for the instance to be included. Source: Law Enforcement datasets